PEPFAR Quality of Care Conference
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- Burning Issues in TB-HIV -

Infection Control

Karin Weyer
Medical Research Council, South Africa

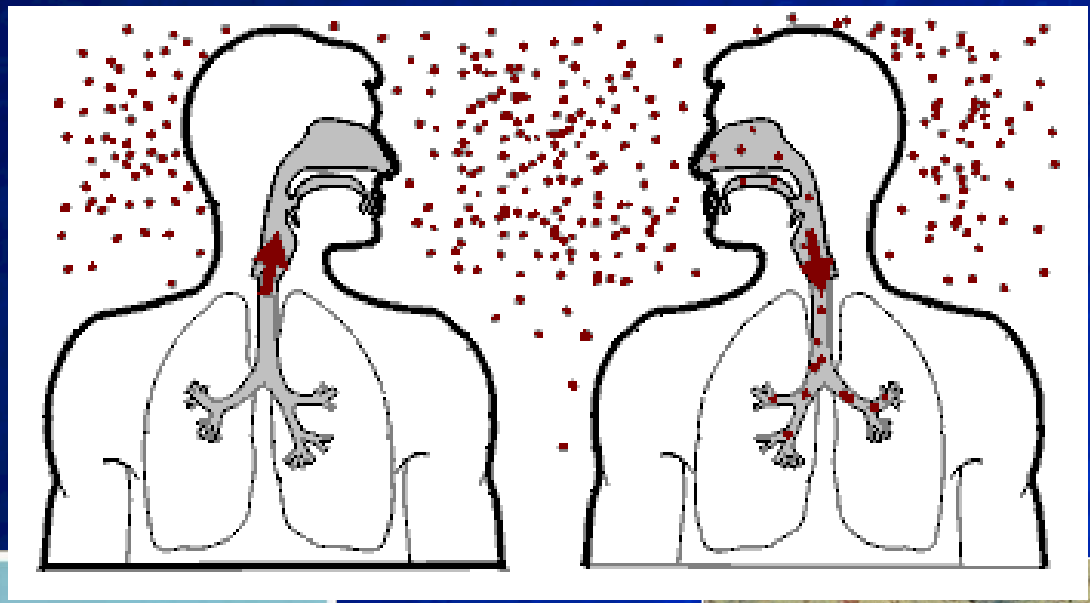
Florence Nightingale

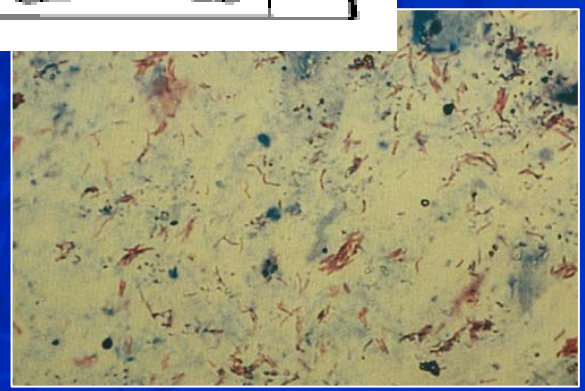
‘*It may seem a strange principle to enunciate as the very first requirement of a hospital that it should do the sick no harm*’

Notes on Hospitals, 1883

Airborne infection

Mycobacterium tuberculosis as prototype





Droplets and droplet nuclei

- Large respiratory particles settle within about 1m of their source
- Fine particles dry into droplet nuclei – diluted and carried by air currents

TB: A global crisis

- One person infected every second
- 9 million new cases annually
- 4 million infectious cases annually
- Causes >25% of preventable adult deaths
- 20% growth in epidemic in Africa

The epidemiological challenge

- HIV greatest challenge
  - TB most common opportunistic infection in HIV+
  - TB leading killer of people living with HIV/AIDS
  - TB often first manifestation of AIDS
- Active TB accelerates HIV progression to AIDS due to enhanced HIV replication

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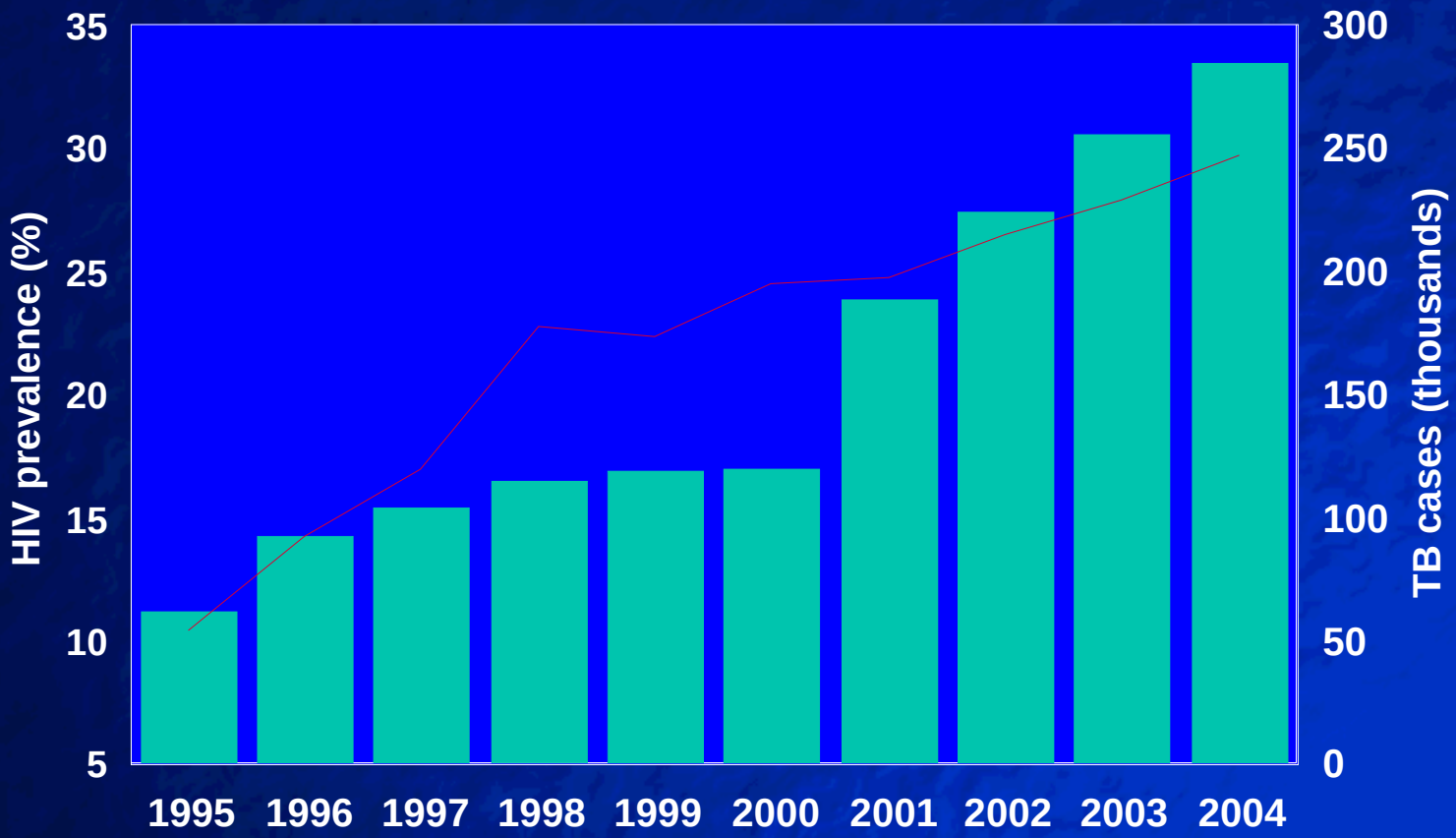
Trends in TB and HIV in South Africa

(Source: Department of Health, 2004)

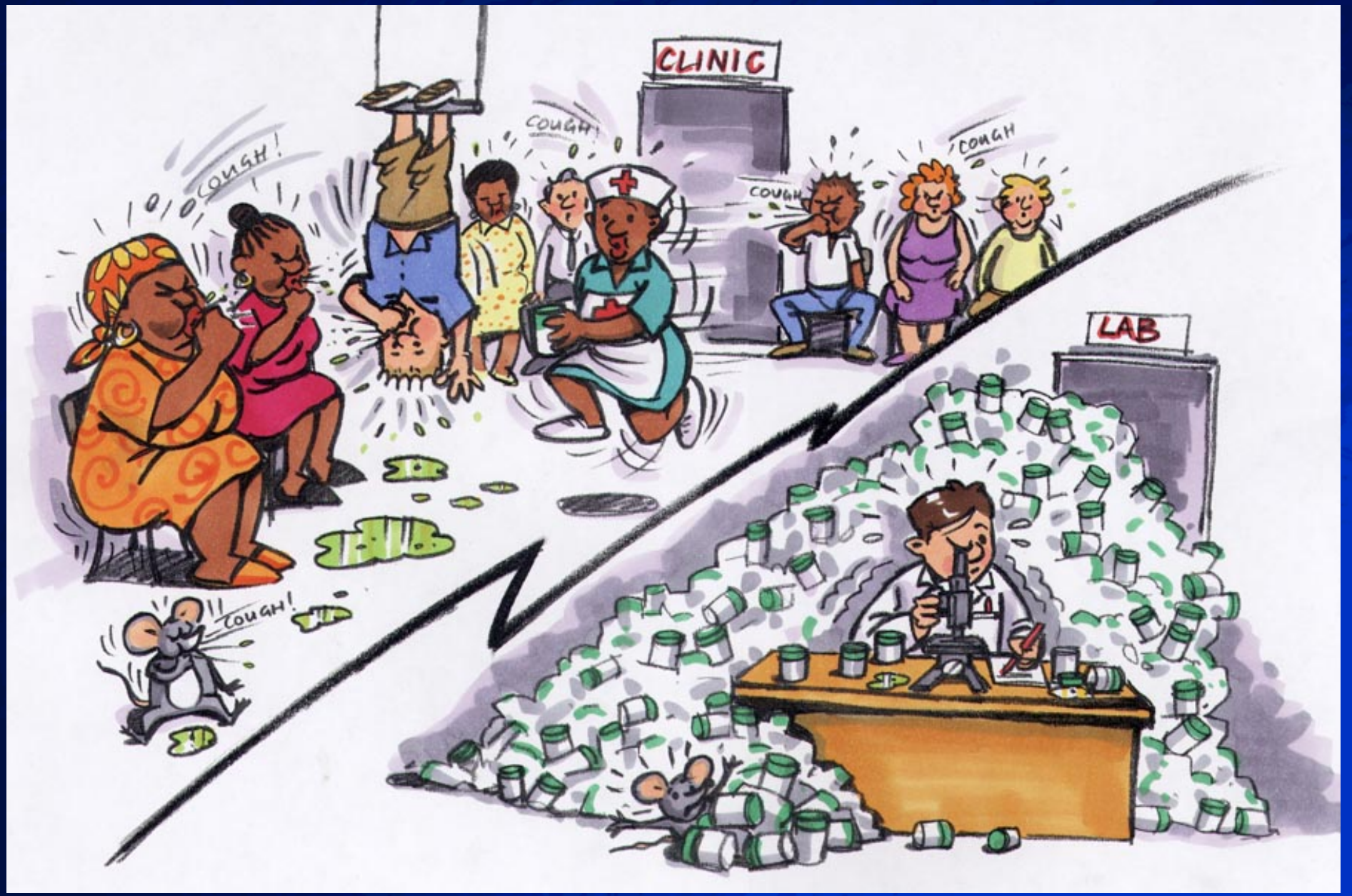


The epidemiological link

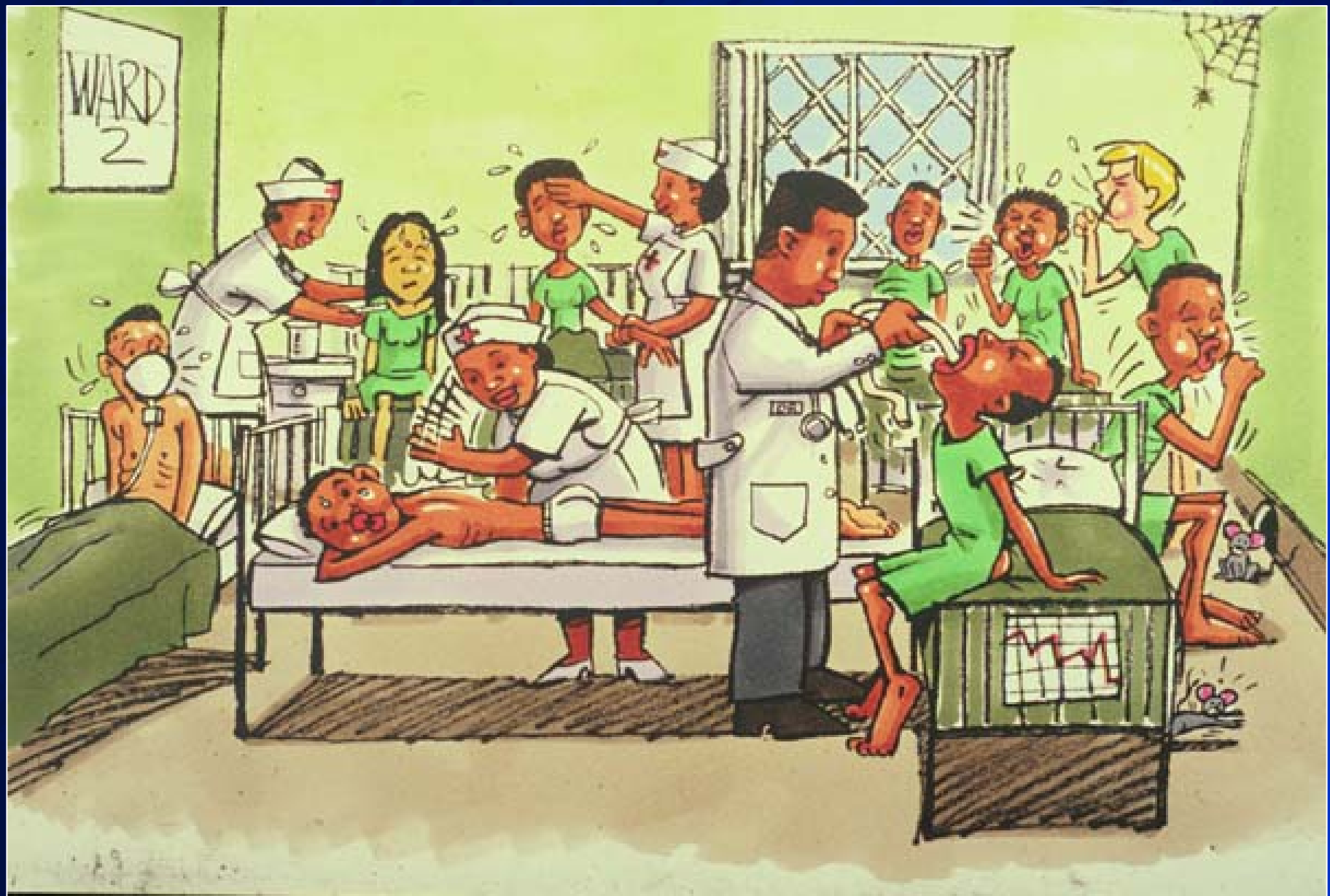
- Risk of active TB disease following infection
  - HIV negative: 10% lifetime risk
  - HIV positive: 10% annual risk

- 55% of TB patients in South Africa also HIV positive (provincial range 30% - 72%)

Overburdened health services



Challenges for infection control



Multidrug-resistant TB

A man-made problem …

- Inappropriate chemotherapy
- Erratic drug supply
- Poor patient management
- Poor patient adherence
- Misuse of TB drugs
- HIV consequences horrific
- Institutional transmission confirmed

Infection control today

- Little or no administrative interest
- Badly fragmented programmes
- No dedicated budgets
- Incident management before prevention
- No proper planning
- Little or no staff training
- Good intentions but little action

Infection control dilemmas

Health facility

- Appropriate design

Interventions

- Capital cost
- Maintenance
- Evidence for efficacy

Clinical

- HIV
- MDR-TB

Overcrowded health facilities

Multi-bed wards

Congregate waiting areas

Poor/no building maintenance

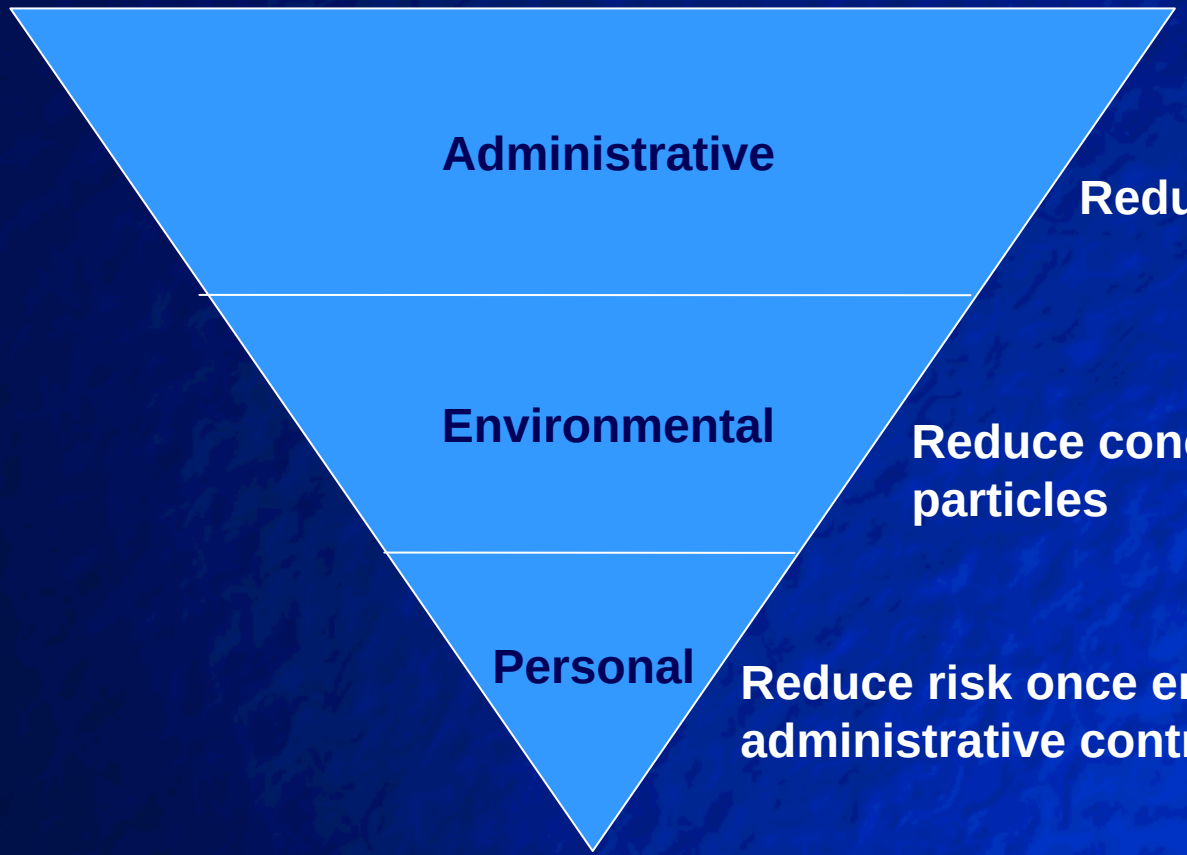
What can be done?

- Administrative controls
- Environmental controls
- Personal respiratory protection

however:

- Evidence of efficacy and effectiveness lacking

Hierarchy of infection control



Reduce exposure

Reduce concentration of infectious particles

Reduce risk once environmental and administrative controls are in place

Administrative controls

- In HIV settings - THINK TB
- In TB settings
  - Rapid diagnosis of infectious cases
  - Rapid triage of infectious cases
  - Rapid treatment of infectious cases
  - HIV counseling and testing
  - Facility risk assessment
  - Infection control plan
  - Staff training
  - Maintenance of environmental controls

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Respiratory protection

- Surgical masks
  - No protection against infectious droplets
  - May limit distribution of large particles
  - Consider for coughing patients
- Respirators (N95)
  - Valuable for aerosol-producing procedures
  - Filter >95% of infectious droplets
  - Fit-testing required
  - Re-useable if properly handled

Environmental controls

- Isolation
  - Expensive
  - Not feasible in high TB-HIV burden settings
- Filtration
  - Removes contaminants from air
  - Does not provide protection in contaminated areas
  - Expensive (capital input and maintenance)
- Ventilation (forced and natural)
  - Air changes per hour important
  - Costly (capital input and maintenance)
  - Evidence for efficacy limited
- Ultraviolet germicidal irradiation
  - Requires adequate air circulation
  - Expensive (capital input and maintenance)
  - Evidence for efficacy lacking

Ultraviolet germicidal irradiation

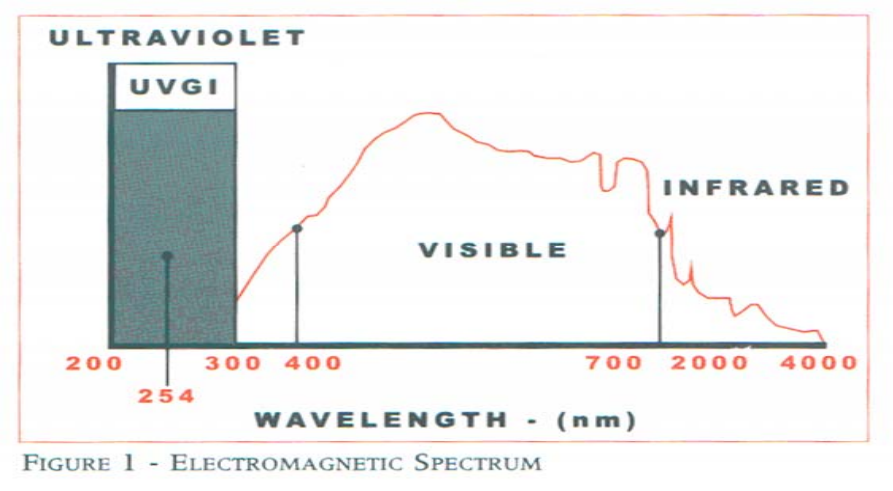
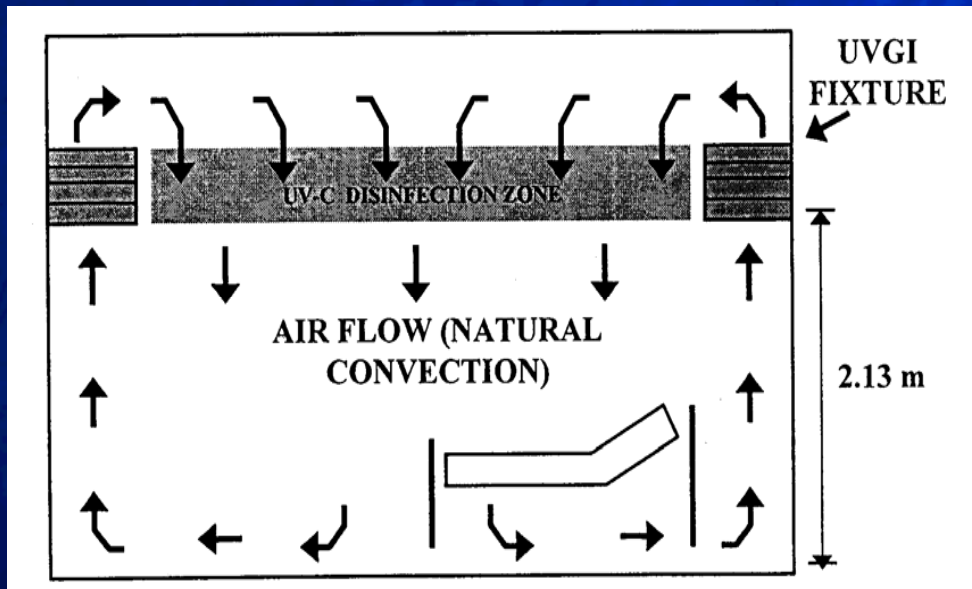


FIGURE 1 - ELECTROMAGNETIC SPECTRUM


Ceiling mount unit with 7.5 or 10 watts UV-C. 360° disinfection zone.



The scientific dilemma

- It is not possible to determine the best environmental infection control interventions unless transmission and infectiousness can be measured
- TB organisms cannot be cultured from the air

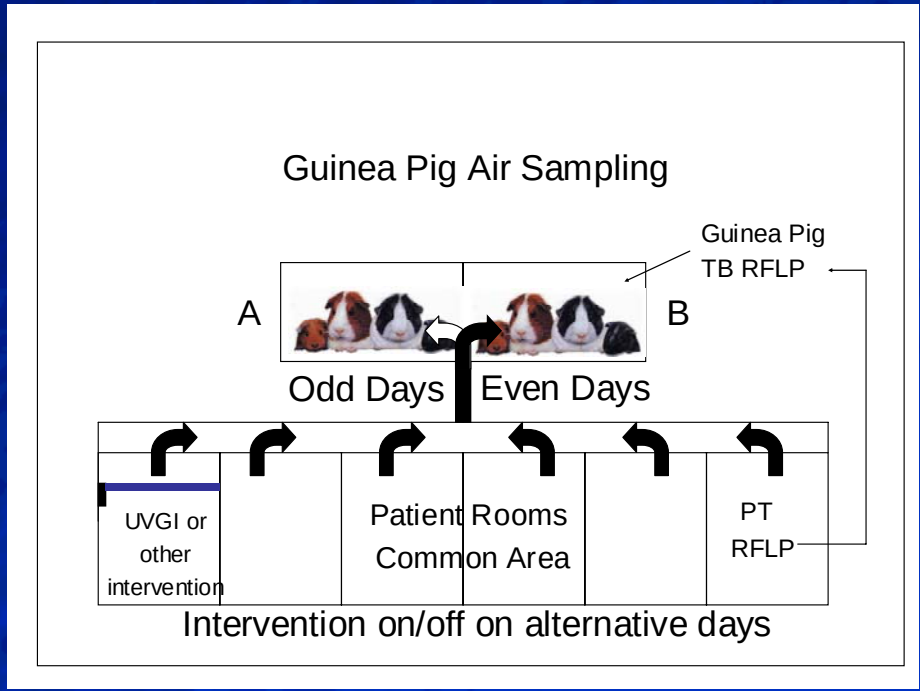
however:

- Guinea pigs are effective quantitative air samplers for TB, reacting in the same way as humans

Airborne Infection Research (AIR) Facility

- State-of-the-art facility established at MDR-TB referral centre in Witbank, Mpumalanga
- Biological model using guinea pigs exposed to air extracted from rooms with MDR-TB patients
- Rate of guinea pig infections a measure of human infectiousness and efficacy of environmental infection control interventions
- Guinea pig strains linked to human sources through genetic fingerprinting

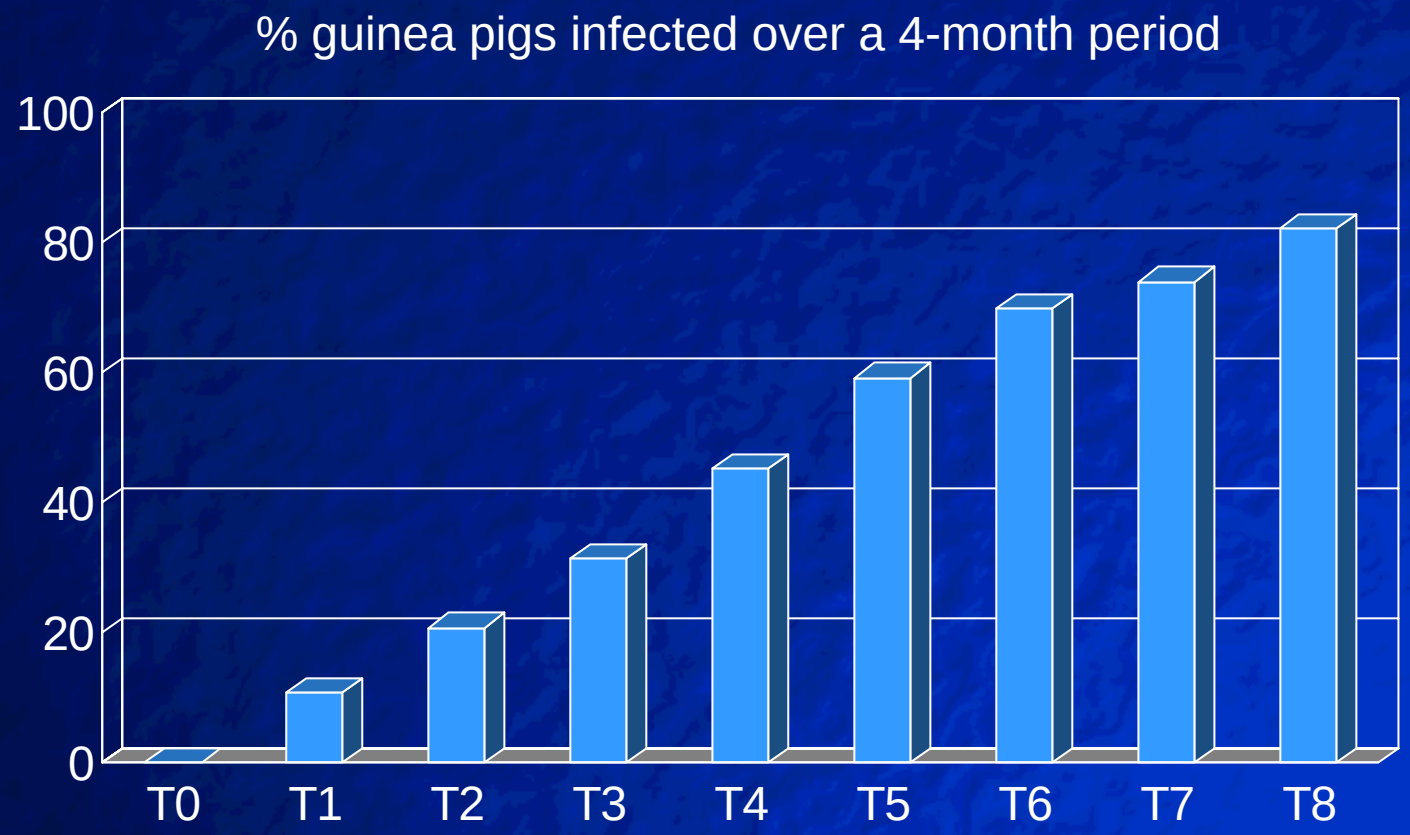
AIR Facility experimental plan



First scientific questions

1. How infectious is MDR-TB?
   What are the predictors of infectiousness?
   Does HIV co-infection alter infectiousness?
2. How long do MDR-TB patients stay infectious?
   When are infection control precautions no longer needed?
3. How effective is opening windows?
4. Does upper room UV air disinfection work under conditions found in South Africa?
   What are the best ways to use it?

Is the AIR Facility working?



What does this mean?

- MDR-TB may be highly transmissible in congregate settings
- Infectiousness of MDR-TB patients can now be quantified
- Efficacy and effectiveness of environmental controls can now be assessed scientifically
- Appropriate design of health facilities for high-burden TB and HIV settings now becomes a reality

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'Everyone has the right to an environment that is not harmful to their health or well-being'

South African Bill of Rights, 1996

Thank you